

The International Institute of Welding: Report on 1998 Actions

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Commission V covers issues of weld inspection and quality control for the International Institute of Welding (IIW). This report summarizes the information presented at the 1998 Annual Assembly: descriptions of both research and draft ISO standards being developed from the research data. The information comes from the various multinational subcommissions, working groups, and task groups within Commission V. Thus, this summary provides an up-to-date review of research activities in other countries and advance notice of standardization activities.

Commission V is composed of subcommissions that cover major (x-ray, ultrasonic, electrical, magnetic, and optical) techniques for nondestructive inspection and quality assurance in welding technology. It also includes a working group with interests in inspection of offshore construction. This year, Commission V met for three days, September 14 to 16, in Hamburg, Germany. Over twenty delegates and experts from fourteen countries attended the meetings. Those who represented the U.S. comprised Tom Siewert of NIST (who served as Chairman and the U.S. Delegate), Krishna Verma of the U.S. Department of Transportation, and Cal Pepper of Black and Veatch Engineers.

Commission V — Quality Control and Quality Assurance of Welded Products

In my role as Chairman, I began the meeting with announcements from the Chairman of Commission's Meeting, as well as a report of the Commission's activities and accomplishments for the last year. Some announcements were: the IIW has accepted Belarus and Libya as new members of IIW, the IIW secretariat is developing an Internet site for the working groups to report activities and communicate their working programs and meeting schedules, and the publisher of *Welding in the World* has announced its intention to cancel its contract, so the journal will be published henceforth by the IIW Secretariat. The next Assembly will be in Lisbon, Portugal from 17 to 22 July in 1999.

Key action items for this week's meetings were:

- We need to select a Chairman for Subcommission VB (on quality systems) to fill a new vacancy, and
- We need to select a Vice Chairman, who can lead when the Chairman is absent.

In addition, we reviewed our plans to hold a NDE standards workshop at the Spring 1999 American Society for Nondestructive Testing (ASNT) meeting, and to hold our intermediate meetings there on the following day. The workshop will have presentations on the different approaches to NDE standards in different countries, and will discuss how to harmonize NDE standards. The draft of the workshop is described in document V-1110-98.

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The complete report of the year's activities of Commission V is available from the U.S. Secretariat as IIW Document V-1100-98, but the accomplishments are also reported below by the respective Subcommissions, in their order of presentation.

A. Subcommission VA — Radiography-Based Weld Inspection Topics

The Subcommission Chairman, H. Heidt, was unable to attend so the Vice Chairman, U. Ewert, led the meeting. He introduced U. Zscherpel, who described the procedures used to digitize the radiographs that are used in our latest film catalog; these procedures allow the original radiographs to be copied with the highest quality. He described how they evaluated various scanners, until they found one with both a contrast sensitivity at least as good as that of a human eye and a pixel size of 40 micrometers (for good resolution). This system also allowed programming of the optical density curve to convert films to the optimum range for optical viewing. After scanning, the useful range of the image data was scaled to the full range of the human eye. They found that they needed a printer that had a density range different from those of typical medical systems. In all, an unusual combination of equipment was required to develop the desired range of properties for the final images. We thanked the researchers at BAM for solving these problems so the radiographic catalogs could now be sold. I read a letter from the task group responsible for overview of this project that agreed that the new procedures were fully acceptable. The Commission members unanimously passed resolution 1, "The latest digital copying technique developed by BAM was found to produce fully acceptable images (compared to the original film radiographs). Therefore, these images are released for sale by IIW, as Reference Radiograph Set V-1056-95".

Next, Dr. Ewert presented a short summary of the status of the Subcommission activities (IIW Document V-1103-98) over the past year. He summarized some details of the film system gradient described in ISO 11699 parts 1 and 2. Unfortunately, the ISO film classes are not the same as those used in Germany or in the U.S. BAM has compared different brands of film and found that most had the same film gradient, but different levels of granularity. They have started a round robin among film manufacturers to resolve this problem. They are also studying whether films and chemical processing solutions can be mixed and matched between manufacturers.

For the working party on Radioscopic Systems for Weld Inspection, he reported that a new standard prEN13068/1-3 is being finalized within CEN. Part 1 covers quantitative measurement of imaging properties, part 2 covers qualitative control and long-term stability of imaging devices, and part 3 covers the general principles of radioscopic inspection of construction materials by x- and gamma-rays. Part 3 has 3 system classes that cover the ranges of 0.4 to 0.6 mm of inherent detector unsharpness, 5 to 20% distortion, and homogeneity of 10 to 30 %. The standard also includes tables for system performance in terms of both single and double-wire image quality indicators for various contrast sensitivities.

U. Zscherpel summarized the CEN activity on standardization of film digitization equipment. This group began by collecting information from various sources. They obtained information from ASTM

E7.02, and they obtained from the Electric Power Research Institute (EPRI) a standard reference film for evaluating the resolution of digitizers. They have evaluated this film and found it to be quite useful in assessing the performance of film digitizers. CEN TC 138 WG 1 has recently developed a draft of a new standard on quantitative measurement of image quality parameters based on the EPRI standard. This means that both the U.S. and Europe can use the same film standard. More details can be found at <http://trappist/CEN-NFD/cenahg3.html>. We passed Resolution 2 "Subcommission VA is forming a new working party, Standardization of NDE Film Digitization, and invites interested parties to contact U. Zscherpel at BAM" to publicize this new working group.

U. Ewert also announced his intention to add the study of new detection equipment to the working program for Subcommission VA. In particular, he proposes to evaluate digital radiography by imaging plates and by new flat detectors.

Finally, he mentioned that the International Atomic Energy Association has received a consultant report on digital radiography in industrial applications. The IAEA report proposes:

- to develop a database on radioscopic education and training in developing countries,
- to hold a workshop on standardization of industrial digital radiography,
- to coordinate research on this topic (including an international comparison of radioscopic techniques under consideration by CEN), and
- to define a low-cost radiographic system.

At the next meeting, we expect to learn the response of the IAEA to this report.

We passed Resolution 3: "Commission V forwards Document V-1111-98, Application of Imaging Plates in the Radiographic Examination of Welding Joints, for publication in Welding in the World".

We decided to hold the next intermediate meeting from 08:30 to 16:00 on the day after our harmonization workshop in March 1999 in Orlando.

C. Subcommission VC — Ultrasonically-based Weld Inspection Topics

The Chairman of Subcommission VC, H. Wustenberg, gave a short summary of his report of the activities during the past year based on both his annual report (IIW Document V-1104-98) and the minutes of the intermediate meeting (IIW Document V-1117-98).

The intermediate meeting of the Subcommission was held at the Institut de Soudure in Paris, France on January 20, 1998.

Highlights from the report included:

- the working group on ultrasonic inspection of stainless steel weldments plans to complete their revision of the handbook on ultrasonic inspection of stainless steel welds in the first half of 1999. A major reason for the revision is to include newer inspection techniques.
- on the topic of validation of ultrasonic techniques for weld inspection, we learned that a recent report from the European Network for Inspection Qualification (ENIQ) is being circulated within the subcommission and that the subcommission has been briefed about the activities of the European Pressurized Equipment Research Council,
- the characterization of IIW ultrasonic calibration blocks and the study of the variations continues at BAM and NIST (summary in document V-1116-98), and
- the working group on automation and imaging for ultrasonic weld inspection is following the progress of the document on ultrasonic testing systems for automatic inspection. The latest draft is dated August 1998 and is being prepared by the German Society for NDT. When the German document is finished, the IIW group will gather documents from other countries and try to develop a consensus document.

Wustenberg offered some comments on the time-of-flight-diffraction (TOFD) technique for ultrasonic inspection. A critical assessment of this technique has shown some cases where interpretation is quite difficult. For example, there can be difficulties in discriminating the upper and lower crack tips, especially for small lack of fusion defects in welds where the signals from the two edges overlap. Also surface breaking cracks are difficult to measure. This can be very important in thin plates, where a lower limit of detection of 3 mm can be a large fraction of the plate thickness. The audience pointed out that some systems combine the pulse echo technique with TOFD to give a greater assurance of detecting cracks in these special circumstances. Wustenberg indicated that further studies are underway.

To generate a better understanding of some of the details of automated inspection, we passed the following Resolution (4):

Commission V invites interested persons to a microseminar, "Manual Versus Automated Inspection: Human Factor Influences and Cost Effectiveness," to be held during the 1999 Assembly.

This microseminar will include contributions for all the various techniques, but will be led by Prof. Wustenberg.

The future work program of subcommission VC includes:

- revision of the Handbook on the Examination of Austenitic Welds,

- elaboration of statements concerning special questions on TOFD and inspection of spot welds,
- revision of the IIW document concerning ultrasonic inspection, especially for the IIW calibration block,
- validation of ultrasonic techniques for weld inspection,
- review of automatic ultrasonic inspection methods (including phased array), and revision of the manual on this topic, and
- acceptance criteria for the ultrasonic inspection of welds.

The next meeting of the subcommission is proposed for Thursday March 25, 1998 in Orlando, in conjunction with the spring ASNT meeting. Our meeting will require about 4 hours, perhaps 8:30 to 12:30. We assigned numbers to documents to be presented at that meeting and to be distributed for next year's Annual Assembly. These were V-1119-98, "Critical Assessments of the TOFD Approach for Ultrasonic Weld Inspection," by A. Erhard, E. Schulz, G. Brekow, H. Wustenberg, and P. Kreier, and V-1120-98, "Characterization of UT Probes and Equipment in View of Phased Array Technology," by H. Wustenberg.

C. Subcommission VE — Weld Inspection Topics based on Electrical, Magnetic, and Optical Methods

G. Dobmann, the Chairman of Subcommission VE, reviewed recent activities (IIW Document V-1106-98).

The subcommittee held one intermediate meeting on January 21, 1998 at the Institut de Soudure in Paris. Dr. Dobmann reviewed the activities of the meeting. At that meeting, we discussed final revisions to A. Doubov's report on the magnetic memory technique, which has now been published in *Welding in the World*. Also at that meeting, the working party on characterization of black light lamps (chaired by R. Marmigi of Italy) delivered draft versions of documents on the use of liquid penetrants at elevated temperatures.

Dr. Peri was present at this meeting and presented the final versions of the two contributions from the Italian Delegation: V-1112-98, "Non-Destructive Testing—Characterization of Penetrants for Hot Surfaces in Weld Inspection," a draft for consideration by ISO, and V-1113-98, "Penetrants for Hot Surfaces in Welding Inspection: Experimental Work and First Results," the technical supporting documentation. We passed two resolutions:

- Resolution 5: Commission V forwards Document V-1112-98, "Non-Destructive Testing—Characterization of Penetrants for Hot Surfaces in Weld Inspection," to ISO through Route

1. (Delegate Votes - 6 for, 0 against or abstain.)

- Resolution 6: Commission V forwards Document V-1113-98 "Penetrants for Hot Surfaces in Welding Inspection: Experimental Work and First Results" for publication in Welding in the World.

Francesco Peri has also chaired the working party on characterization of nonmetallic welds. Several years ago, Dr. Peri prepared and circulated a questionnaire on experimental research and standardization activities, but received replies from only 2 countries. The scope of the questionnaire was broadened to include thermal-barrier coatings and corrosion-protection coatings. The questionnaire was distributed again to the Delegates but only one reply expressed interest. Meanwhile, a presentation at the intermediate meeting by the Russian delegation indicates that they are a major source of information on this topic.

Dr. Dobmann summarized the magnetic memory technique, as described in Document V-1096-97, and described a proposal to compare the information from this technique with that obtained from other techniques for measuring stress and strain. Many of the other techniques (x-ray diffraction, ultrasound, and hole-drilling techniques) have limits to their range of applicability. Such a comparison would provide quantitative data on the capabilities of the various techniques.

To announce the status and to promote these two activities, we passed the following 2 resolutions:

- Resolution 8: Subcommittee VE announces a new working party, "Round Robin to compare Magnetic Memory to other Stress Measurement Techniques." Interested persons should contact G. Dobmann at IZFP.
- Resolution 9: Subcommittee VE announces a new working party, "Control of Welds in Polyethylene using NDE Techniques," which will be chaired by N. Khimchenko of the Russian Delegation.

The future working program includes:

- low-frequency eddy-current inspection for replacement of magnetic particle inspection of ferritic weldments,
- eddy-current and other electromagnetic inspection of bonded airplane structures, especially for "hidden corrosion,"
- hot inspection of welds by liquid penetrants,
- new activities on thermographic inspection of welds,
- questionnaire on nonmagnetic weldments, and

- organization of a European Project on residual-stress measurements (including Russia, Bulgaria, Romania, Poland, and Western European Countries).

The intermediate meeting will be held in Orlando after the harmonization workshop. It will require about four hours (perhaps 14:00 to 18:00) and could follow the meeting of Subcommittee VC.

D. Subcommittee VB — Quality Assurance

We had no annual report because of the vacancy in this Chairmanship. Therefore, our most important task at this meeting was to elect a new chairman who could drive and direct our activities in this area. We had announced this opportunity during the first 2 days of the meeting (to give potential candidates a chance to gather support), and held an election on the third day of our meetings. To announce the results, we passed the following resolution: "Commission V has elected C. Pepper of the U.S. delegation as the Chairman of Subcommittee VB."

Next, we discussed how to strengthen some of the topics, such as real-time monitoring and a revision of ISO 9000 that is now in the DIS status. Also, we discussed how to overcome the barriers due to the different approaches that now exist in various countries, and how to construct components with a wide range of quality, including lower quality, which meets the internal needs of developing countries.

For now, the working program remains the same:

- formulating a concept for quality management in welding (to clarify the relationship between existing standards and investigate the need for new standards),
- formulating a guideline for quality management in welding (to help the user to select a quality management system adequate for their organization), and
- collecting information on computer-aided quality control, on-line weld monitoring, fitness for purpose, and acceptance criteria in welding (to define the need for further support in applying these tools).

E. Special Commission V Microseminar on Standards for Quality Management in Welding Shops

Subcommittee VB had begun planning this session about a year and a half ago, but the resignation of the Chairman several months ago left the microseminar in jeopardy. Fortunately, D. von Hofe, the Director of the German Welding Society, is a strong supporter of this activity and agreed to finish the planning and to chair the session. At the start of the microseminar, I introduced Dr. von Hofe and invited the attendees to the Subcommittee meeting the next morning.

In this half-day seminar, we had 10 presentations, including both presentations on specific aspects of quality management and the status of the use of ISO standards in the major countries. The microseminar was well attended (by about 40 people) and was intended to encourage further participation in Subcommittee VB. The papers are being collected for duplication and distribution within the Commission.

Closing comments and observations by the Seminar Chairman included: There is a definite movement to international standards (such as ISO), these standards will likely go head-to-head with the American standards, we should try to make the standards more complete and simpler to implement, and we need to get broader input from all the countries.

F. Subcommittee VF — Weld Defects and Their Significance

We discussed the reactivation of this subcommittee, which has been inactive for several years. Although we have not identified a candidate for chairman, we found a number of topics which might be considered by this subcommittee. For example, advances in statistical techniques allow greater assurance of proper inspection. Meanwhile, we asked Olaf Forli to meet with Steve Maddox to consider organizing a microseminar on the significance of weld defects and how they interact with fatigue and fracture calculations. (Late in the week I learned that Commission XIII proposes a joint workshop for 1999 with Commission V on the topic of the capabilities and deficiencies of NDT methods for detecting and sizing flaws that can influence fatigue life.)

Olaf Forli gave a presentation on Document V-1115-98 "Guidelines for NDE Reliability Determination and Description." Some of the lessons that they have learned through their studies are: NDE reliability studies are very expensive, NDE is less reliable than might be hoped, the interpretation of interfering defects is very difficult, the description of reliability and definition of reliability parameters is extremely difficult, different techniques give different results, and it is very difficult to apply the resulting plan.

Next year, he expects to present the next report in the Det Norske Veritas NDE series. This will be on guidelines for development of NDE acceptance criteria.

He discussed the issues related to use of information on NDT reliability. In general, reliability data must be presented in a realistic and consistent way, with uniform ways to apply the criteria. All these issues are considered in V-1115-98. The NDE process includes: detection, characterization, evaluation/assessment, and rejection/acceptance. However, if the cost of false detection is very high, then false calls must be described.

He announced that there will be a Second European-American Workshop on NDE Reliability and Validation in Boulder, Colorado in 1999.

F. Working Group 2 — Inspection of Offshore Welded Construction

In the absence of the chairman, A. Raine, O Forli presented a report and the contribution of this working group, IIW Doc. V-1107-98.

He described the status of the revision of *Information on Practices for Underwater NDE*, IIW 1033-89 (V-908-89). This revision is being driven by new developments in remote inspection and electromagnetic techniques. It has been reviewed by the Subcommittee VA, VC, and VE Chairmen. It is being readied for publishing by Woodhead Publishing Limited.

He continued with a summary of (a) the annual report (Document V-1107-98), (b) a report by Alan Raine on changes in inspection for oil and gas installations (Document V-1114-98), and © a report on guidelines for NDE reliability (Document V-1115-98).

In summary, some offshore inspection trends are: Less underwater inspection, more topside inspection (for example, corrosion), more extensive use of newer electromagnetic techniques, a substantial reduction in inspection by magnetic particles, and more extensive use of detection of flooding of sealed members to learn of penetration, extended use of remotely operated vehicles, and use of cost- or risk-based inspection.

He also discussed advances in the development of acceptance criteria for defects in pipeline girth welds. Automated examination of ultrasonic pipeline girth welds is now much more feasible and is included in the 1996 DNV pipeline rules.

One of the major concerns has been a reduction of interest in this group. Its members are considering their future and what their work program should be. For now, the working program includes review of new problem areas and new techniques such as:

- personnel qualification systems for offshore NDT,
- reliability of offshore NDT techniques and compilation of test trial data,
- comparison of surface inspection techniques,
- offshore/underwater electromagnetic techniques and applications,
- underwater NDT equipment,
- recent developments in automated and remotely operated NDT systems,
- downhole inspection,
- recent developments in local and global structural integrity monitoring techniques for

offshore structures, and

- inspection systems, planning and cost optimization, including probabilistic techniques.

G. Miscellaneous Commission V Items

Resolutions passed at the meeting were:

- 1 The latest digital copying technique developed by BAM was found to produce fully acceptable images (compared to the original film radiographs). Therefore, these images are released for sale by IIW, as Reference Radiograph Set V-1056-95.
- 2 Subcommittee VA is forming a new working party, "Standardization of NDE Film Digitization," and invites interested parties to contact U. Zscherpel at BAM.
- 3 Commission V forwards Document V-1111-98, "Application of Imaging Plates in the Radiographic Examination of Welded Joints," for publication in Welding in the World.
- 4 Commission V invites interested persons to a microseminar, "Manual Versus Automated Inspection: Human Factor Influences and Cost Effectiveness," to be held during the 1999 Assembly.
- 5 Commission V forwards Document V-1112-98, "Non-Destructive Testing - Characterization of Penetrants for Hot Surfaces in Weld Inspection," to ISO through Route 1.
- 6 Commission V forwards Document V-1113-98, "Penetrants for Hot Surfaces in Welding Inspection: Experimental Work and First Results," for publication in Welding in the World.
- 7 Commission V has reelected Tom Siewert as Chairman for the term 1999 to 2001.
- 8 Subcommittee VE announces a new working party, "Round Robin to compare Magnetic Memory to other Stress Measurement Techniques". Interested persons should contact G. Dobmann at IZFP.
- 9 Subcommittee VE announces a new working party, "Control of Welds in Polyethylene using NDE Techniques," which will be chaired by N. Khimchenko of the Russian Delegation.
- 10 Commission V has elected C. Pepper of the U.S. delegation as the Chairman of Subcommittee VB.
- 11 Commission V has elected G. Dobmann of the German Delegation as the Vice Chairman of Commission V.

New documents generated at the meeting were:

- V-1118-98 Minutes of the Meeting - September 14, 1998,
- V-1121-98 Minutes of the Meeting - September 15, 1998, and
- V-1122-98 Minutes of the Meeting - September 16, 1998.

We plan to hold our Commission V intermediate meetings in conjunction with the ASNT spring meetings in Orlando, Florida. The proposed dates for these meetings are:

- Subcommission VA - March 25, 08:30 to 16:00,
- Subcommission VC - March 25, 08:30 to 12:30,
- Subcommission VE - March 25, 14:00 to 18:00, and
- Subcommission VB - not yet decided.

Working group 2 will hold its intermediate meetings independently.

Commission XIII passed a resolution (8) to arrange a joint workshop for 1999 with Commission V on the topic of the capabilities and deficiencies of NDT methods for detecting and sizing flaws which can influence fatigue life. The Commission V contact will be O. Forli.

Concluding Remarks

The chairman's report of our activities and accomplishments for the last year is available from the American Council, or from the Government Printing Office, as National Institute of Standards and Technology Internal Report 5069. For further information on the activities of the commission or to forward a report for their consideration, contact T.A. Siewert at (303) 497-3523. If you want to obtain any of the documents or become a member of the American Council (the group that coordinates the U.S. representation at the Annual Assemblies and keeps files of all the reports) contact the American Welding Society at (305) 443-9353, extension 313.